

Ultra-hard Steel Developed Through Computational-based Modeling



TECHNOLOGY

NASA Glenn routinely conducts research on transmissions and gearing for advanced gas turbines promoting safety, weight reduction, and reliability. QuesTek Innovations, LLC, a small, innovative materials solutions company, partnered with NASA Glenn's Mechanical Components group to evaluate the fatigue performance of one of the company's proprietary gear steels.

COMMERCIAL APPLICATION



QuesTek provides unique materials solutions to a variety of customers using its powerful mechanistic computational models. The company develops steels and alloys optimally balanced for strength, toughness, and corrosion resistance in half the time and at a fraction of the cost of traditional empirical development.

QuesTek developed a carburized, martensitic gear steel with an ultra-hard case using its computational design methodology, but needed to verify lifecycle performance and overall reliability. Battelle introduced the company to NASA Glenn Research Center's Mechanical Components group and facilitated a partnership allowing researchers at NASA Glenn to conduct spur gear fatigue testing. NASA Glenn's spur gear fatigue rig provides accelerated fatigue life testing by investigating the effects of materials, heat treat, shot peen, lubricants, etc on the gear's performance. Testing revealed that QuesTek's gear steel outperforms the current state-of the art alloy in contact fatigue by almost 300%. This testing generated necessary data to quantify fatigue benefit attainable using QuesTek's material.

SOCIAL/ECONOMIC BENEFIT

With assistance from NASA Glenn and Battelle, QuesTek commercialized two new steel alloys based on the testing results generated through this partnership. These alloys combine maximum case hardness with a tough, ductile core, promoting high wear and contact fatigue life and offer a 20% increase (or more) in gear endurance in high power density aerospace transmission systems. NASA and QuesTek are co-authoring a paper and will present the promising results at ASME's Power Transmission and Gearing conference later this year.

NASA APPLICATIONS

Since 1972, NASA Glenn's spur gear fatigue rig has set the standard for gear surface fatigue experiments enabling development of robust, efficient, and safe gas turbines and rotocraft. NASA has an interest in developing vertical take-off and landing vehicles based on conventional rotocraft but with the speed and high altitude performance of turboprops. Advancements in gear design and reliability makes possible the development of these highly specialized vehicles.

Point of Contact:

Battelle

The Business of Innovation

Phone: 216/898-6400
Fax: 216/898-6550
20445 Emerald Parkway Drive, S.W.
Cleveland, OH 44135



ttp@grc.nasa.gov
Phone: 216/433-3484
Fax: 216/433-5531
21000 Brookpark Road
Cleveland, OH 44135